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TECHNICAL STUDIES ON NORMAL LUNGS*

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As medical technologists, all of you are aware that the laboratory is of very vital importance to every branch of medicine, and may be called upon for many varied procedures. Some of the technical work is in an experimental stage and its value is still questionable, but there is no doubt at all that the preparation of human tissues for microscopic study is of well established importance. From the slides prepared by the technician it is possible to study the morphologic changes which reflect the presence and progress of disease in the tissues of the body. Thus far, unfortunately, there often seems to be a remarkable lack of correlation between the pathological histology and functional abnormality of many organs. This lack of correlation can lead to only two conclusions; the first, that functional disease may leave no mark on the structure of the organ; and second, that the present methods are inadequate for discovering these morphologic changes. We can progress only if we accept the second conclusion and strive to work out new and improved techniques for the preparation of material for study. I hope that the

* *Read before the American Society of Medical Technologists, San Francisco, Calif., June, 1938.*

work which I am reporting may contribute something toward this improvement in technique.

I should like, at this time, to say a few words regarding the reasons for beginning the investigation of lung structure, so that you will be better able to follow the development of the technique. The Child Research Council of Denver is studying a group of average healthy children from birth to maturity, in an effort to determine the variations in structure and development consistent with normal growth. Social, clinical, radiological, and laboratory studies are made at three month intervals on each child and all of these studies are correlated in every possible way. In the course of such a program it is inevitable that many questions should arise which must be approached by special methods of research in the various departments of the related sciences. The laboratory departments are often called upon to investigate particular problems which have arisen in the more general study. One of these problems is based on the need for more accurate knowledge of lung structure, so that better estimation of the x-rays can be made.

At present the x-ray is practically our only aid in determining and localizing pathological changes in the lungs and because of the extreme subjectiveness of the interpretations it should be carefully checked whenever possible by anatomic study.

In spite of the tremendous volume of work already done on lung anatomy, the fundamental structure is not yet entirely clear. There is still a great deal of controversy about the amount of lymphatic and connective tissue in and extending from the hilum of the so-called normal lung; this makes estimation of pathological change extremely difficult from both histologic and radiographic standpoints. The basic need appears to be for more complete information concerning the normal growth changes in the hilar portion of the lung. We are using lungs from children and young adults in our study of this problem. The presence of gross pathological change, or the history of past pulmonary disease, makes material of no value. So far the work is in a most elementary stage as we have had only a few cases to work on. No conclusions can be given from our study at the present time. However, a technique for the preparation of the material has been worked out which is

very simple and gives a rather complete picture of the entire organ, in fair detail. It is of this technique that I wish to speak today.

The ordinary type of lung sections are of limited value because of their extreme smallness and the resulting incompleteness of the picture given. They are also modified and distorted by the very nature of the lung as an expansile organ, since the mechanical action of cutting tends to collapse the tissue. In the past efforts have been made to obtain a condition of expansion by injection of the pulmonary vessels with a fixing solution before opening the thorax. This method has proved quite satisfactory as the expansion of the lung is limited by the thoracic wall and is that of the individual at the time of death. This method did not seem suitable for our work, however, because of the need for selected cases and the impossibility of selecting material before seeing the gross tissue. Of course, all cases could have been injected and the suitable ones chosen later for extensive study but this would have necessitated a great deal of unnecessary work. A second method which has been used is the unmeasured artificial inflation of isolated lungs by way of the air passages, with subsequent fixation in fluid. In this method the amount of inflation and its constancy during fixation are difficult to control.

Moolten,[1] in 1935, developed another interesting technique. He placed a whole lung in an air-tight chamber, allowing the bronchus to be open. He then established suction from the chamber and allowed the lung to expand under the pressure of the atmosphere until he believed it to be normally inflated. He measured the amount of negative pressure in the chamber which surrounded the lung by means of a water manometer and kept this pressure at between 10 and 20 cm. of water. After the lung had reached the desired expansion he slowly introduced fixing solution through the open end of the bronchus until the lung was entirely filled with fixative. He allowed the lung to remain stationary and fixing for from twelve to eighteen hours. This technique appeared simple and we have patterned ours after it in some respects. We found, however, that fluid introduced into the air spaces immediately produced great pressure in the lung and caused overdistension and some tearing of

[1] Moolten, S. E.: A Simple Apparatus for Fixation of Lungs in the Inflated State. Arch. Path. *20*:77-81, 1935.

the alveolar walls. In other words the fine control of expansion was entirely lost as soon as fluid was placed in the lung and it was made to hang like a bag full of water. Moolten's success and our failure may depend on the fact that he used pathological tissue from older individuals which was apt to be fibrotic and more resistant to internal pressure than the normal tissue of young individuals, which we have used.

We have modified the technique to fit our needs, and have worked out a method for fixation of the tissue without the introduction of fluid. This has been accomplished quite easily by means of formaldehyde gas, which is obtained by heating a concentrated solution of formaldehyde in water and this gas is passed directly into the air passages. In a closed system enough pressure is developed to inflate the lung to the desired degree of expansion and the speed and extent of the inflation can be easily controlled by regulating the rate of heating of the formaldehyde solution. The pressure in the lung is watched by means of a water manometer incorporated in the system. The formaldehyde gas combines with the moisture in the lung to form a solution which will partially fix and harden the tissue. Thirty to sixty minutes are sufficient for this partial fixation.

After the tissue has been so treated it is firm enough so that it can be immersed in fixing fluid without any appreciable collapse. In this way fixation is completed and the tissue prepared for sectioning.

It is possible to take these lungs and embed them directly in celloidin, and subsequently to cut them into thin serial sections. The length of time that this would necessitate for infiltration has made it seem more practical to us to cut the fixed material into slabs.

The method is made somewhat clearer by noting the diagram of the apparatus[2] (Fig. 1). The lung is prepared with as much bronchus left attached as is possible. Tears large enough to interfere with inflation must be sealed over by cauterizing the lung surface with a hot iron and sealing with celloidin-soaked cotton. The bronchus is attached to a metal tube by means of a sufficient num-

[2] I am indebted to Mr. J. J. Wirz for his mechanical assistance in designing and constructing the apparatus.

ber of rubber bands to make it hold firmly to the tube in spite of the weight of the suspended mass. The small metal tube is attached by its threaded upper end to the longer tube which is in the cover of the fixing container. As soon as the lung is in place the lid of the chamber is fastened down. The flask at the right contains about 100 to 400 c.c. of concentrated formaldehyde solution and this rests in a water bath. The amount of formaldehyde solution is dependent on the size of the lung which is to be fixed. The side arm of the distilling flask is connected by means of tubing to the metal tube which holds the bronchus, and the apparatus is ready for the fixing process to be started.

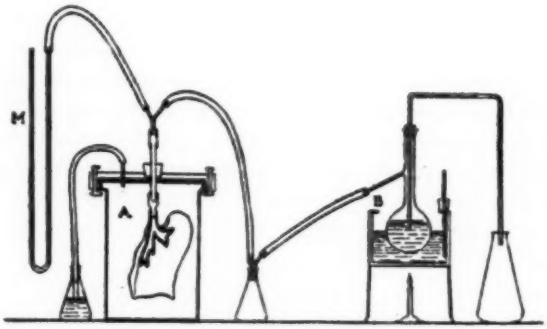

DIAGRAM OF APPARATUS FOR FIXATION OF LUNG BY MEANS OF FORMALDEHYDE GAS

M. *Manometer*
A. *Fixation chamber*
B. *Source of formaldehyde gas*

Figure 1.

As you see, a manometer is attached by a Y tube, in such a way that the pressure of the gas introduced into the lung can be measured continuously. The small flask introduced in the tubing through which the gas passes is for the purpose of removing water of condensation so that there will be no obstruction to the passage of the gas into the bronchus. In any closed system there is some danger

of an obstruction developing which may constitute a danger of explosion and this is guarded against by the remaining parts of the apparatus. In the event of escape of gas through small tears in the lung substance, or through diffusion, a positive pressure might be built up in the fixing chamber and the manometer reading falsified; this is guarded against by having an outlet tube from the chamber. This outlet tube is run just under the surface of water to prevent escape of gas into the room. As a safety measure in case of obstruction in the tube leading from the distilling flask to the lung, a long glass tube is placed in the distilling flask. This extends from the bottom of the fluid to a height of about twice the expected number of centimeters of water pressure, and is further extended into an empty flask by rubber tubing. Thus in case of a block the pressure in the distilling flask will be lowered by the passage of the solution up this tube and out, before a danger point has been reached.

After the lung has been well fixed, it is washed in running water for several days and is then ready for embedding. For the purposes of study we x-ray the lung at this time. We first x-ray the whole lung and then cut it into slabs about one centimeter thick; each of the individual slabs is also x-rayed. These radiographs aid us in accurately locating the sections, as well as contributing to our special investigation.

The slabs of tissue are then embedded and sectioned. Celloidin technique is used and it is essentially the same routine method as that used in most laboratories. The material is dehydrated in graded alcohols, placed in ether-alcohol, and from that in thin celloidin for about two weeks. It is then placed in thick celloidin for about two more weeks and after that is evaporated in a closed dish for several days, or until the blocks of tissue can be cut out from the surrounding celloidin. Chloroform vapor, in a closed dish, is our method for hardening the celloidin and this takes about an hour. We then place the tissue in a mixture of cedar oil and chloroform for 48 hours. During the first half of this time the cedar oil and chloroform are half and half; and during the second 24 hours the solution is 1 part chloroform and 3 parts cedar oil. The blocks then are placed in pure cedar oil for 24 hours or longer and the process of clearing is completed. The tissue blocks are then ready to mount on cutting bases.

The method which I have just outlined is quite rapid and entirely satisfactory, but in case time is no object or the cost of cedar oil is prohibitive, the longer method can be used. In this the tissue is left in each celloidin solution for four or five weeks and then embedded and transferred to 70% alcohol for cutting. The slower method is superior in case the blocks have to be kept for a number of months before cutting, as the cedar oil makes the tissue increasingly hard after months of storage.

The blocks which have been prepared, by either method, are then attached to the cutting bases with heavy cellodin in the routine manner. Mounted blocks are then stored in cedar oil for about 24 hours or, in case the slower method has been used in 70% alcohol. They are then ready for cutting.

The sections are cut on a large microtome, using 70% alcohol to flood both the knife and the block . We have found 20 microns to be a satisfactory thickness for the sections. Thinner ones are apt to tear during the staining process but can be handled with extreme care if great microscopic detail is desired. After being cut the sections are placed in 70% alcohol and washed several times to remove all of the cedar oil as it interferes with the staining if left in the tissue.

The staining may be done by any method which is satisfactory after formalin fixation. The sections are carried unmounted through the staining solutions. We have found that creosote is most satisfactory for clearing as the tissue and celloidin flatten out easily and can then be mounted on large slides without wrinkling. With the use of creosote it is posible to transfer the sections directly from 95% alcohol to the clearing fluid and so avoid the softening effect of absolute alcohol.

The mounting must be done in thick balsam, either under cover glasses or between two slides. After mounting, the cover glasses must be weighted for 24 hours in order to keep the sections flat. It is then safe to clean the slides before reapplying the weights and baking in an oven at 56° for about 48 hours.

A small piece of thin onion skin paper, on which the identifying legend has been heavily typewritten, may be fastened to the slide

with a drop of Duco Cement. Then when the cover glass is put over it the label is neat and permanent.

It is plain that this technique is very well adapted to the study of normal lung tissue, in which gaseous penetration is rapid and adequate as a fixing method. The sections obtained give a complete picture of the structure of all parts of the lung, and allow one to see clearly the relative amounts and locations of the more dense tissues which make up the structural framework of the respiratory portion. Comparison with the x-rays further aids in analysis of the lung structure and the microscopic slides aid in better interpretation of the radiographs. The fixing process is obviously adapted to lung tissue alone, but any well fixed organ may be embedded in celloidin and cut into large sections . Such material is useful in research but is also of great value in teaching and lecturing. A complete picture is obtained of large pathological lesions with enough of the surrounding tissue to allow comparison with more normal structures.

I am indebted to Marguerite Jenks for technical assistance.

Plate I. Case 1.

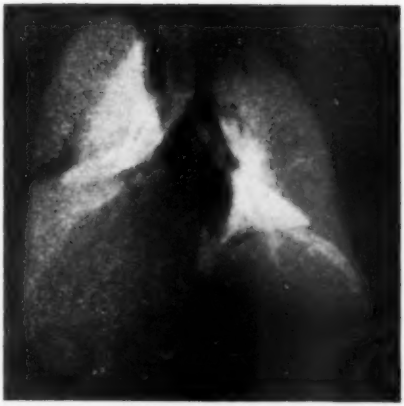

Fig. 2. Reproduction of x-ray of whole normal lungs of newborn infant, inflated and fixed with formaldehyde gas.

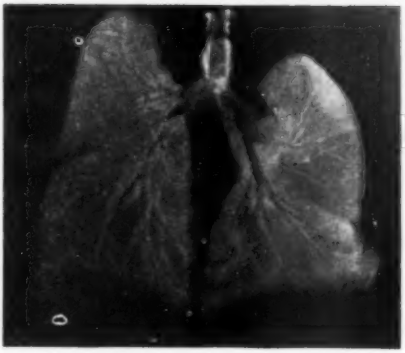

Fig. 3. Reproduction of x-ray of frontal section, approximately 1 cm. thick, through the hilar region of lung shown in Fig. 2.

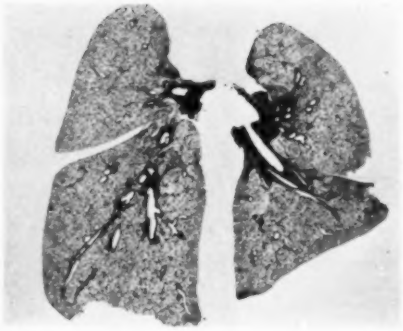

Fig. 4. Photograph of a celloidin section, 20 microns thick, from the frontal section shown in Fig. 3.

Plate II. Case 2.

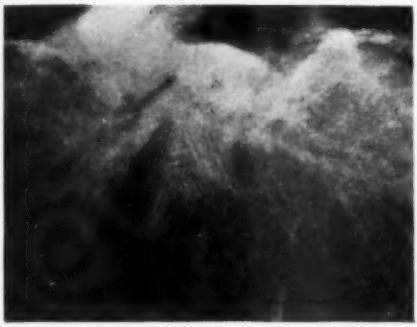

Fig. 5. Reproduction of x-ray of whole normal right lung of a 5-year-old child, showing mid-portion from hilum to periphery, inflated and fixed with formaldehyde gas.

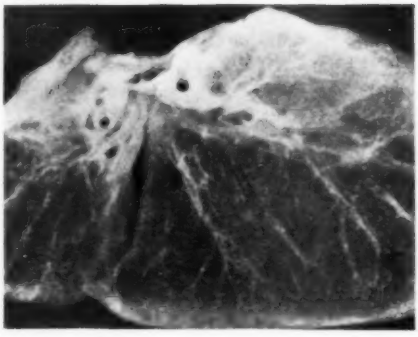

Fig. 6. Reproduction of x-ray of frontal section, approximately 1 cm. thick, through the hilar region of right lung shown in Fig. 5.

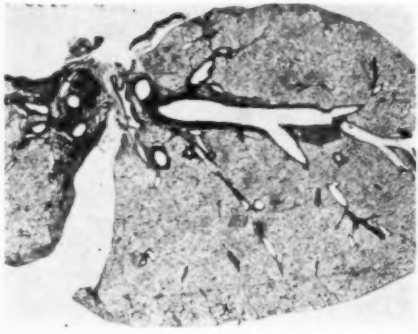

Fig. 7. Photograph of a celloidin section, 20 microns thick, from the frontal section shown in Fig. 6.

LATE GROWTH IN BLOOD CULTURES

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Blood cultures in cases of Streptococcus septicemia are frequently negative. Heeks and Famulener[1] reported 93 cases of Streptococcus viridans infection with 12% of positive cultures, the average growth appearing 2.3 days after the culture was taken. This organism grew the slowest in their series of 6000 cultures. Typhoid and Staphylococcus aureus averaged two days each, Streptococcus hemolyticus 1.6 days, Staphylococcus albus 1.5 days, and pneumococcus 1.3 days.

Swift[2] states there are bacteria free stages of subacute bacterial endocarditis recognized, which may be due to absence of living micro-organisms in the blood stream or to a high bactericidal power of the blood. Some authors, as Lane[3], give 72 hours as the longest time to observe the cultures, and it is customary in many laboratories to discard the cultures after 3 or 4 days. Levinson and MacFate[4] give 5 to 10 days as the time to observe before reporting no growth. In the description of the clot method of Cecil and Nichols in the same book, it is stated that if no organisms can be demonstrated in 30 days the blood is considered sterile. Todd and Sanford[2] state that cultures should not be discarded as negative for 10 days to 2 weeks.

One factor usually considered to have an influence on the number of positive cultures obtained is the amount of blood used. If too much is used the serum itself is inhibitory, if too little there are not enough organisms. Kepni[5] believed the importance of the bactericidal influence of the blood to have been overestimated, but, his own experiments show that there was still a considerable difference. Straus[6], on the contrary, believed that blood is definitely inhibitory and cited experience and experiments to prove the contrary. Fox and Leaman[7] advise taking a large amount of blood, 50 to 100 cc., and concentrate the organisms by defibrinating, hemolyz-

ing and centrifuging, thus removing the inhibiting influence of the whole blood.

Case Report: N. P., white male, aged forty-two, was seen July 5, 1936. The onset was two months previous with pains in joints, chills, and high fever. There was a history of two previous attacks since 1920, loss of appetite and 35 pounds in weight. His chief complaint was palpitation of the heart. Physical examination showed a to and fro murmer over the precordium, marked pulsation of peripheral arteries, Corrigan pulse, liver edge two fingers below the costal margin, red cells in urine and petechia.

Eight blood cultures in all were taken. Four of these were positive for Streptococcus viridans, the first on the eleventh day, the second on the seventh day, the third on the sixth day, and the fourth on the third day. The others were reported negative by George Washington University Laboratory, although not held over six days. The first two positive blood cultures were obtained at the home, on August 1st., and the other August 14th., 8 cc. of blood were taken for 100 cc. of media. He was admitted to George Washington University Hospital August 24, 1936, where the third and fourth positive cultures were obtained. He died September 23, 1936.

Autopsy: Bacterial endocarditis with vegetations of aortic and mitral valves.

This patient lived 54 days after the first positive culture was obtained which was longer than any in Lawson's[8] series of 15 cases in which the longest period was 50 days.

Conclusions: Because blood has an inhibitory influence on the growth of streptococcus viridans from blood cultures, several cultures should be held two weeks before being reported negative.

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ENDAMEBA HISTOLYTICA*

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Endameba Histolytica was first described by Lösch in 1875 under the name Ameba coli. He gave a concise microscopic and clinical description, and experimentally infected a dog with the organism. Other workers confused Endameba coli with the organism described by Lösch and a consequent confusion resulted for a number of years. In 1883 Koch described ameboid bodies found in intestinal lesions and liver abscesses. In 1913 Walker and Sellards demonstrated the pathogenicity of Endameba histolytica as the causative agent of amebic dysentery in man . They also demonstrated the role of carriers in the disease. It has been estimated that approximately 10% of the population in temperate climates, and a somewhat higher percentage in the tropics, are carriers of Endameba histolytica. (1)

Although it is essential that one be able to identify such ameba as Endameba gingivalis, Endolimax nana, Iodameba butschlii, and Dientameba fragilis, for practical purposes the laboratory identification of Endameba histolytica consists of differentiating this ameba from Endameba coli. Infection with these organisms may exist either separately or together (2).

One of the most confusing objects to be found in stool specimen is Blastocystis hominis, a harmless yeast-like mould with a characteristic central vacuole, present in large numbers in many stools. Large macrophages containing red blood cells may be mistaken for ameba if not carefully examined (3).

Three forms occur in the life cycle of Endameba histolytica, the trophozoite or vegetative form, the precyst, and the cyst. The

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* *Read before the American Society of Medical Technologists, St. Louis, Mo., May 19, 1939.*

vegetative form is motile and reproduces by binary fission. It lives in the ulcerative areas of the colon and is most likely to be found in diarrheal stools or after saline catharsis. Examination should be made as soon as possible after passage of the specimen, slides and all materials used in handling should be warmed. If bloody mucous is present in the stool, this should be used in making preparations. Warmed normal saline or distilled water may be used to dilute the specimen if necessary. Ameba are located with the low power lens and studied with the high power and oil immersion lens. The microscope diaphragm should be nearly closed.

As the diarrhea of active cases subsides and the feces remain longer in the colon, the ameba lose motility, begin to round up, and become preencysted. Culture is the examination of choice for such semi-solid stools containing precysts because of the difficulty of identifying the organism in this phase. Cultured in vitro the precysts vegetate giving rise to trophozoites.

As the stool remains still longer in the colon and becomes formed, the precysts encyst giving rise to cysts containing one to four nuclei. Feces containing cysts should be examined diluted with water or saline, or with a solution of 5% aqueus iodine in 10% potassium iodide. Stained preparations may be made for further study or permanent mounts.

Only trophozoites are found in the secondary locations, such as lung or liver abscesses. These trophozoites are to be found in the abcess walls and not in the central necrotic material (4). Fresh warm preparations should be made as the organism soon disintegrates. Specimen may be obtained directly from ulcers in the rectum or colon. These are placed on a slide, diluted if necessary, and examined for trophozoites.

All stool specimen should be collected in clean dry containers, free from chemicals, and should be examined as soon after passage as possible. Oil, barium, and medications render the specimen unsuitable for examination. Repeated examinations should be made on fresh material with water, saline, or iodine mounts, stained slides, and by culture. At least six specimens should be examined by various methods before a negative report is given (3). These exam-

inations should be made on specimen obtained normally and on specimen obtained after saline catharsis (4).

Although a small race of Endameba histolytica exists having a diameter no greater than 12 microns, the usual vegetative form is 20-30 microns in size. It possesses active motility directional in character, by means of large highly refractile pseudopodia which pull the ameba out in a band-like form. The entire contents of the organism flows into or toward the extended pseudopodium. In fresh preparations the motility is rapid, motility decreasing with elapsed time after passage of the stool. The clear ectoplasm is easily distinguished from the granular endoplasm. Many red blood cells in digestive vacuoles are often to be found in the endoplasm, but bacteria and intestinal debris are never ingested except when the organism is cultivated in vitro. The nucleus is rarely visible in fresh preparations, and then only indistinctly. The chief basis of identification of Endameba histolytica is to be found in the nuclear structure. In stained specimen small beads of chromatin of uniform size line the nuclear membrane. The karyosome, a small dot of deeply staining chromatin, is located centrally in the nucleus, surrounded by a clear area from which extend to the nuclear membrane a fine network free from chromatin granules.

The vegetative form of Endameba coli, 20-25 microns in size, is usually smaller than Endameba histolytica, and moves more slowly, frequently changing its direction. The pseudopodia are smaller, more rounded, and not so highly refractile. Frequently more than one pseudopodium is produced at a time. The ectoplasm and endoplasm are not so clearly defined. The endoplasm is more coarsely granular than that of Endameba histolytica and contains numerous food vacuoles of bacteria, crystals, pus cells, yeast, etc. As a rule red blood cells are not ingested, but when present, are in lesser numbers than in Endameba histolytica. The nucleus is usually clearly visible in fresh preparations. In stained preparations the nucleus exhibits irregular coarsly granular chromatin lining the nuclear membrane, a fairly large, prominent, eccentric karyosome, and bits of chromatin on the network extending from the karyosome. The vegetative forms of Endolimax nana, Iodameba butschlii, and Dientameba fragilis are usually smaller than Endameba histolytica

or Endameba coli, the nucleus is rarely visible in fresh preparations, they contain many food vacuoles, and soon lose motility (5).

The precystic form of Endameba histolytica is smaller than the vegetative form, round or oval, and motion is usually absent, however occasionally it may continue to send out very small blunt pseudopodia. It is hyaline in appearance and free from granular material. The nucleus is typical. A thin delimiting membrane covers the organism. In this stage differentiation from precystic Endameba coli is very difficult and a search for other developmental forms of the organism should be made.

Precystic Endameba histolytica secretes a delicate cyst wall and encysts. The cysts are still smaller, varying from 7 to 15 microns, small races averaging as little as 5 microns. In the early stage then contain one nucleus, a large mass of glycogen, and usually one or more chromidial bodies having the appearance of rods with blunt ends. There are two nuclear divisions resulting in the formation of four nuclei. During nuclear division the glycogen gradually disappears and the chromidial bodies also disappear as the cyst becomes older. The cysts are easily seen in fresh preparations due to their clear glassy appearance and gray-green color. The chromidial bodies show best in moist preparations. Frequently the four nuclei are near the four poles of the cyst.

Endameba coli cysts have a thicker wall than Endameba histolytica, and usually, when mature, contain eight nuclei. As a rule the nuclei are bunched. An abundant mass of glycogen is present in the young cyst. Chromidial bodies are splinter-like with sharply pointed ends. In the single nuclear stage the nucleus is large, becoming progressively smaller with increased nuclear division.

While the key to the identification of Endameba histolytica lies in the finding of the four typical nuclei in the cystic form, one must bear in mind the fact that at one stage in the development of Endameba coli there are four nuclei, and occasionally the cysts of Endameba histolytica have more than four nuclei (5). Stained preparations will show the characteristic nuclear structure.

The only method of transmission of amebiasis is by means of the cysts of Endameba histolytica. In acute infections only the tropho-

zoites are excreted, which are not infective. Cysts pass out of the body, and the life cycle of the organism is completed when it enters the gastro-intestinal tract of a new host through milk, water, food, etc. Cysts are very resistant to drying, changes of temperature, and chemicals (6). Excystation takes place in the large intestine of the new host.

At the time of excystation the four nuclei begin to show movement, and the ameba retracts from the cyst wall. The wall ruptures, a pseudopodium is extended, and the ameba leaves the wall. The four nuclei usually collect in a mass and follow the extended pseudopodium. The individual nuclei separate, taking a portion of the cytoplasm with them. Occasionally, however, there is a binuclear division followed by a uni-nuclear division. Rarely "giant" forms (1) occur through numerous nuclear divisions and increase in cytoplasm without cellular division.

After formation of the vegetative form, the mucosa of the large intestine is attacked. In 1932 Hiyeda and Suzuki (7) described amebic invasion as a penetration of the mucosa with erosion extending to the muscularis mucosa and lateral extension to form craters. A balance may be maintained between ameboid erosion and fibrous tissue replacement, usually with no display of symptoms. In such case, the individual becomes a carrier and the excretion of cysts may infect others. In the examination of carriers, concentration of cysts may be carried out, as well as culture and other methods of examination.

In iodine preparations of cysts, the cytoplasm is stained yellow, the cyst and nuclear walls a darker yellow, and the glycogen dark brown. The karyosome stands out as a refractile body.

If stained preparations are desired, a number of slides should be made from each specimen. One of the best stains for the purpose is Heidenhain's iron-hematoxylin stain (3) (8), with a light eosin counterstain. The material should be perfectly fresh, properly fixed, and at no time in the process should the slides be permitted to dry. If necesasry, the specimen may be diluted with saline. Smears are made with a brush or applicator, should be uniform and not too thick.

With the iron-hematoxylin-eosin stain, the trophozoites exhibit a very light pink or unstained ectoplasm, a deeper pink endoplasm, often with black-staining red blood cells, and a spherical nucleus which shows a black chromatin rim with a black, centrally placed, karyosome. A lighter staining linin network extends from the karyosome. The cysts exhibit a very lightly stained or unstained cytoplasm, and the nuclei stain as in the trophozoite phase. One or two black or dark brown chromidial bodies, appearing as bands or rods with blunt or tapering ends, are often found.

A simple concentration method for cysts of Endameba histolytica is to emulsify a small piece of feces in distilled water, strain through two layers of gauze, centrifuge at moderate speed for two minutes, decant, emulsify as before, and repeat the washing two or three times. The final sediment is examined with water or iodine or may be stained by the iron-hematoxylin method.

Washed cysts are used for innoculating media for culture. The specimen is mixed with about 500cc of water, filtered through four layers of gauze into a cylinder, and allowed to settle for three hours, during which time the cysts settle to the bottom. This washing is repeated at least three times. The sediment will contain fewer bacteria than are present in the original specimen. It has been learned that washed cysts will remain viable at room temperature for as long as nine days, and for thirty-five days in the refrigerator (9).

For cultivation, washed cysts are innoculated into a medium consisting of nutrient broth containing a starch-charcoal mixture. This media was developed by H. Tsuchiya (9), and is very favorable for Endameba histolytica but does not support the growth of Endameba coli. The nutrient broth consists of Peptone 10gm., Meat Extract 3gm., NaCl 5gm., in one liter of distilled water. The pH is adjusted to 7.0. Eight cc quantities are distributed into tubes and autoclaved at 15 pounds pressure for 30 minutes. Two parts of rice starch and one part of animal charcoal are mixed and sterilized by dry heat at 180° for 45 minutes. Rice starch provides assimilable carbohypdrates for the ameba and inhibits the growth of Blastocystis hominis. The charcoal adsorbs ammonia and hydrogen sulphide, and induces a partial anaerobiasis.

About 0.1cc of washed cysts is introduced into 8cc of the broth, previously warmed in the incubator, and two 4mm loopfuls of the starch-charcoal mixture are added. The tube is incubated at 37°. Subcultures are made every 48 hours onto Dorsett's egg medium on which 5cc of the broth-starch-charcoal mixture is superimposed, in order to insure a good growth.

After an incubation period of 24 to 48 hours, the sediment is gently scraped from the bottom of the tube with a wide-mouthed pipette, and a small amount of the sediment containing charcoal removed. The ameba are usually found clinging to the charcoal. The sediment is placed on a warm slide, covered with a cover slip, and examined, preferably on a warm stage.

The ameba soon begin to extend pseudopodia and to cross the field rapidly. A small loopful of 0.1% neutral red gives the endoplasm a pinkish refractile tinge, facilitating examination without interfering with motility.

Infection with Endameba histolytica is not uncommon, and since the disease is transmitted from man to man by means of contaminated food and liquids, the detection of carriers is of great importance. Laboratory examinations are of primary importance in the detection of both active cases and of carriers. Present laboratory methods include examination of fecal material and material from abcess walls, by means of water, saline, or iodine mounts, stained smears, and culture; and the complement fixation test (10) (11). Importan phases of examination of material are collection, selection, and preparation. No one method of examination should be used to the exclusion of other methods.

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THE DEMONSTRATION OF TUBERCLE BACILLI BY GASTRIC LAVAGE IN PULMONARY TUBERCULOSIS

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The procedure of examining the stomach contents for tubercle bacilli is not new, and was first suggested by Meunier (1) of France in 1898. Apparently no further references are to be found until 1927 when Armand-Delille (2), also of France, published the results of lavages on a series of tuberculous children. Since then it has been used more widely, especially for children, who very frequently swallow their sputum.

This procedure was first used at Manitoba Sanatorium on November 15, 1932, and exactly 500 consecutive tests were done between that date and November 15, 1937. An analysis of the results from this series is reported in this paper.

Literature

Since 1930 a considerable number of reports have been published on gastric lavage for tubercle bacilli, especially in Europe and America, but it has been thought unnecessary to review all of them.

In Armand-Delille's (2) series mentioned above 31 per cent of 110 children, considered only as suspects, and whose x-ray films were practically normal, had tubercle bacilli in their stomach contents. A special concentration method was used to treat the material obtained by lavage. In 1936, before a Parisian medical society, he (3) gave further interesting results: 100 per cent of 52 cases of ulcerative pulmonary tuberculosis positive; 76 per cent of 50 with infiltration type positive; and 53 per cent of 17 with miliary tuberculosis positive. Saye, et al., (4) did lavages on 107 tuberculous

children under 10 years of age and found 44, or 41.1 per cent, positive as proven by guinea pig inoculation. In general French doctors seem to be quite enthusiastic over this method, especially for children. Piechaud and Bacquet (5) (6) recommend it for adults as well as for children and have used it regularly since 1930 in their diagnostic clinic at Bordeaux, France, for incipient and latent tuberculosis. They emphasize the need of a very careful technique to produce good results.

In Denmark, Clausen (7) found positive by lavage about 50 per cent of 136 adults with "abacillary" pulmonary tuberculosis and about 55 per cent of 152 children with pulmonary tuberculosis. In 1934, Poulsen and A. O. Andersen (8) gave the results of lavages on 622 tuberculin-positive children. They found 199, or 32 per cent, positive for tubercle bacilli. Of these children, during the first year of life they found 87 per cent positive, during the second year 46 per cent, during the fifth year 25 per cent, and during the ninth year 14 per cent. The method of examination used in the above series is given by Lester (9). Direct smears were examined but these were usually negative. Part of the gastric material was then homogenized by acid and a part by alkali after which cultures were planted and guinea pigs inoculated. K. Andersen (10) performed gastric lavage on 389 Pirquet-positive children under four years of age over a period of five years and found 207, or 53.2 per cent, positive.

In Vienna, Hacker and Wallis (11) reported 15 out of 50 tuberculin-positive children, or 30 per cent, to have bacilli in their stomach contents as proven by animal inoculation.

In Italy, Zambrano (12) found 8 out of 50, or 16 per cent, of children under 12 years positive. Some were clinically active, others inactive.

Considerable use has been made of gastric lavage in the United States, a great deal of the work having been done in New York City in the Metropolitan and Sea View Hospitals and in the Laboratories of the Department of Health. In 1932, Kereszturi, et. al., (13) published a preliminary report on 40 tuberculin-positive children

aged two to ten years. Most of them were afebrile and all were gaining weight. Seven, or 17.5 per cent, had tubercle bacilli in their stomach contents as proven by guinea pig inoculation. One year later, the same workers (14) reported 101 cases which included the 40 already mentioned. The ages ranged from 8 months to 16 years and their condition from merely a positive tuberculin reaction to far advanced bilateral destructive disease. If the aspirated material was negative by smear, guinea pigs were inoculated. Twenty-eight children, or 27.7 per cent, were found positive. In a third communication in 1934, Mishulow, et al., (15) gave the results of a special comparative study of 60 children out of the series reported in 1933 by Kereszturi, et al. The feces contained tubercle bacilli in 26.6 per cent of the cases while 33.3 per cent of the lavages were positive.

Two other reports have come from the hospitals mentioned in the paragraph above. The first, in 1933, by Ulmar and Ornstein (16) was on 259 sputum-negative cases of pulmonary tuberculosis. The lavages in 55, or 21.2 per cent, were positive as proven by smears made after sodium hydroxide digestion preceded and succeeded by prolonged centrifugalization. The second by Gray and Melnick (17) in 1935 reported a study of gastric acidity in pulmonary tuberculosis, but also the examination of the stomach contents for tubercle bacilli. Forty-two out of a series of 50 had positive sputum and of these 31, or 73.8 per cent, had tubercle bacilli in their stomach contents. None of the eight with negative sputum was positive by lavage. These authors observed that as the gastric acidity decreased tubercle bacilli were found more frequently in stomach contents.

From California in 1934, Gourley (18) reported a study of 59 tuberculous children all under 13 years of age. Fifty had lesions demonstrable by x-ray while the other 9 had only positive tuberculin reactions. Twenty-eight, or 47.5 per cent, were proven to have tubercle bacilli in their stomach contents.

Outline of Study

Our series consisted of 382 patients, 166 males and 216 females.

Three hundred and sixty-five had pulmonary tuberculosis, 4 had pleurisy with effusion and 13 had non-tuberculous conditions. Of those with pulmonary tuberculosis one had childhood, 38 minimal, 132 moderately advanced, and 194 far advanced disease. The average age of the males was 31.3 years, of the females 25.9 years, and of the whole group 28.2 years. The youngest patient was a girl of 11 and the oldest a man of 67.

In many of the cases the gastric contents were examined as an aid in diagnosis, especially when there was x-ray evidence of pulmonary tuberculosis and the sputum was negative or, as was frequently the case, there was none at all. In patients whose sputum had been positive on admission but had become negative due to successful treatment the test was frequently used, especially if the patient was about to be discharged. Other patients on whom the test is being used are those who have had thoracoplasty operations. Following each stage of the operation the sputum is examined weekly for tubercle bacilli and after it has been negative for several months the gastric contents are examined as a final check. In a few cases in which the sputum was known to be positive the gastric contents were examined for bacilli at the time tests were being made for acidity as we were interested to determine whether or not these patients were swallowing sputum. This phase of the subject will be discussed more fully later.

A total of 500 gastric examinations were made, 208 on men and 292 on women. Two hundred and eighty-nine patients had a single test, 73 had two, 15 had three, and 5 had four.

Technique

The technique of gastric lavage is relatively simple and it may be followed by the usual gastric analysis for acidity if so desired, although usually both examinations are not required at the same time. The method is the same as used in the laboratories of the Metropolitan and Sea View Hospitals and the Department of Health, New York City.

The patient must not have breakfast until the stomach has been

emptied but may drink water if he wishes. We now use the Levine duodenal tube, which is passed through the nose, rather than the older Rehfuss tube which is swallowed by mouth. It causes less discomfort to the patient and is easier to use. The first foot or two of the tube should be well oiled with glycerine or mineral oil. The tip is carefully introduced into a nostril and slowly shoved up into the nasal passage. Often the tip encounters obstruction but gentle twisting or moving up and down of the tube will usually get it moving freely again. It is important not to use too great force as it may hurt the patient's nose. Often the other nostril will admit the tube more easily and should be tried. When the tip of the tube reaches the esophagus the patient should be instructed to swallow a few times. With slight shoving on the tube by the technician it will usually start down the esophagus and can almost be shoved down into the stomach without swallowing. There are some patients with sensitive throats who start to cough when the tube reaches the lower pharynx. A little encouragement often helps to get him to co-operate better and to get the tube going nicely but if there is excessive coughing the back of the throat should be sprayed with 2 per cent nupercaine solution from an atomizer. Breathing through the mouth helps to prevent coughing and retching. It is very seldom that the patient is met who cannot swallow the Levine tube. A coughing patient should cover the mouth with gauze and the technician should be on his guard against a patient coughing in his face. The patient should be given a special gown to wear over his clothes to protect them.

The stomach contents are aspirated as completely as possible by using moderate suction on the syringe. Unless the quantity of material is large the stomach is washed out with about 100 cc. of 0.9 per cent sodium chloride solution. All the material obtained is put into a conical sedimentation glass and allowed to stand for 30 to 60 minutes.

The supernatant fluid is now poured off until about 50 cc. remains which contains most of the sedimentated sputum. An equal quantity of 3 per cent sodium hydroxide is added and the mixture is thoroughly stirred with several wooden applicators. The alkali is allowed to act for 15 minutes after which the material is cen-

trifugalized for 15 minutes. The fluid is drained off and two smears are made from the residue, using an albumen fixative. Sometimes there is difficulty in getting the material to stick to the slides and the smears should be made a little thicker than in the case of sputum. They are stained in exactly the same manner as sputum. In the decolorizing processes the slides should be washed very carefully as some of the material almost always washes off.

Each slide is carefully examined microscopically for five minutes before being reported as negative. Positive findings are recorded according to the modified Gaffky scale.

General Results

In presenting the results of our experience with gastric lavage the emphasis is placed on "tests" rather than on "patients", i.e., each test is considered as if done on a different patient, due to the fact that a patient's status in regard to sputum may change from negative to positive, or vice versa, in a few months or even weeks.

Table 1 gives a detailed presentation of the positive results of the 500 lavages done on the 382 patients in our series who are classified according to the type and extent of disease present:

TABLE 1. SUMMARY OF GASTRIC LAVAGES FOR TUBERCLE BACILLI

Classification	Cases	Lavages	Lavages Positive for Tubercle Bacilli	
			Number	Percentage
All conditions	382	500	121	24.2
Pulmonary tuberculosis	365	481	121	25.2
Childhood, combined*	1	1	1	100.0
Adult, minimal	38	45	3	6.7
Adult, moderately advanced	132	190	46	24.2
Adult, far advanced	194	245	71	29.0
Pleurisy with effusion	4	4	0	0.0
Non-tuberculous conditions	13	15	0	0.0

* Includes tracheo-bronchial and parenchymal disease.

It will be seen that tubercle bacilli were found in the gastric contents in 121 instances. As would be expected all the positive results were in cases of pulmonary tuberculosis. In the 4 patients who had pleurisy with effusion and the 13 with non-tuberculous conditions all examinations of gastric contents and sputum were entirely negative. These 17 patients may be considered as a small control group.

The one patient having the childhood type of disease was a girl of 14 who had no sputum but tubercle bacilli were found in her stomach contents. In 38 patients with minimal pulmonary tuberculosis 3 out of 45 lavages, or 6.7 per cent, revealed tubercle bacilli; in 132 with moderately advanced disease 46 out of 190 lavages, or 24.2 per cent ,were positive; while in 194 with far advanced disease 71 out of 245 lavages, or 29.0 per cent, were positive.

The positive results were about equally distributed between the sexes. Of 166 males with pulmonary tuberculosis bacilli were found in 50 out of 208 lavages, or 24.0 per cent, while of the 216 females 71 out of 292 lavages were positive, or 24.3 per cent.

One of the most important findings of this analysis was the frequency with which a gastric lavage was the *first* method to demonstrate tubercle bacilli coming from a pulmonary lesion. Of 107 patients having positive gastric lavages 66, or 61.7 per cent, were first found to have bacilli by this method.

Gastric Contents and Sputum Compared

In order to have a basis for comparison the results of the gastric contents examinations were compared with those of sputum. The examinations of the *three* months previous to the lavages were recorded as *positive* if one positive test had been found during that time, *negative* if all tests had been negative, and *absent* if no sputum had been obtained for examination. In the case of thoracoplasty patients, who have sputum examined at weekly intervals, a period of *two* months was taken instead of three. Table 2 presents the results of this comparison:

TABLE 2. COMPARISON OF EXAMINATIONS OF GASTRIC CONTENTS AND SPUTUM FOR TUBERCLE BACILLI

Classification	Cases	Lavages	Tests Positive for Tubercle Bacilli		
			Sputum	Gast. Cont.	Gain
			%	%	%
All conditions	382	500	11.2	24.2	13.0
Pulmonary tuberculosis	365	481	11.6	25.2	13.6
Childhood, combined*	1	1	0.0	100.0	100.0
Adult, minimal	38	45	4.4	6.7	2.3
Adult, moderately advanced	132	190	6.8	24.2	17.4
Adult, far advanced	194	245	16.7	29.0	12.3
Pleurisy with effusion	4	4	0.0	0.0	0.0
Non-tuberculous conditions	13	15	0.0	0.0	0.0

In the whole group of 365 patients with pulmonary tuberculosis 11.6 per cent of the sputum examinations and 25.2 per cent of the gastric contents were positive, hence it will be seen that the number of positive findings were more than doubled by the use of gastric lavage.

The one patient in the childhood group had no sputum but a positive gastric lavage. The group was too small from which to derive any conclusive results.

In 38 patients the disease was minimal. Of 45 lavages done 3, or 6.7 per cent, were positive, while in 2 cases, or 4.4 per cent, the sputum was positive two to three months previously, a gain of 2.3 per cent in positive results.

In 132 the disease was moderately advanced. Of 190 lavages done 46, or 24.2 per cent, were positive while in only 13, or 6.8 per cent, was the sputum positive, a gain of 17.4 per cent. Gastric lavage showed its value perhaps better in this group of patients than in any other.

In 194 the disease was far advanced. Of 245 lavages done 71, or

* Includes tracheo-bronchial and parenchymal disease.

29.0 per cent, where positive while in 41 cases, or 16.7 per cent, the sputum was positive, a gain of 12.3 per cent.

Gastric Lavages in Sputum-Positive Cases.—Fifty-six lavages were done on patients with pulmonary tuberculosis who had tubercle bacilli in their sputum two to three months previous to the examinations. Of these 27, or 48.2 per cent, were positive. One would rather expect a much higher result than this, in fact, Gray and Melnick (17) in a series of 42 sputum-positive persons found 73.8 per cent of the lavages positive. One of the reasons for the low results is the fact that the two tests were not done on the same day in every case. Frequently the sputum will change from being positive to negative within a two-month period in response to treatment. In a number of patients with known positive sputum we examined the stomach contents as aspirated for acid tests and in almost every case found tubercle bacilli; however, it must not be concluded from this that every patient with sputum swallows it regularly.

Gastric Lavages in Sputum-Negative Cases.—Two hundred and fifty-four lavages were done on patients with sputum negative for two to three months before the lavage in each case. Of these 31, or 12.2 per cent, were positive for tubercle bacilli. This result is considerably less than the sputum-negative series of 259 patients of Ulmar and Ornstein (16) who found 21.2 per cent positive. It will be recalled that we use their technique so our results are more or less comparable. In the last two or three years we have been using the test more and more on patients likely to be negative, e.g., thoracoplasty patients with negative sputum and this has materially lowered the number of positives in this group.

Gastric Lavages in No-Sputum Cases.—One hundred and seventy-one lavages were done on patients having no sputum for two to three months previous to lavage. Of these 63, or 36.8 per cent, were positive. This is one of the most interesting and important findings of the whole study and shows how valuable the test may be in such cases. It is obvious that many of these patients actually did have sputum and were swallowing it, which can be done more or less unconsciously, and is more likely to happen when the quantity is small and difficult to raise. It is worthy of note that 45 of

the positive gastric examinations were done on women while only 18 were on men.

Table 3 summarizes the findings from the lavages done on the tuberculous patients who are classified according to their sputum findings:

TABLE 3. SUMMARY OF GASTRIC LAVAGES IN PULMONARY TUBERCULOSIS

Classification	Total Lavages	Lavages Positive for Tubercle Bacilli	
		Number	Percentage
Sputum positive	56	27	48.2
Sputum negative	254	31	12.2
Sputum absent	171	63	36.8
	481	121	25.2

Comment

Some question might be raised as to the identity of the acid-fast bacilli found in stomach contents. All distinct acid-fast bacilli found in our examinations were considered to be tubercle bacilli although no guinea pigs were injected to determine pathogenicity. In cases of doubt the results are given as negative. No record of non-pathogenic acid-fast bacilli in stomach contents could be found, and such an occurence must be very unusual. For all practical purposes, then, all acid-fast bacilli found in such material may be considered to be tubercle bacilli.

It is well known that children and infants swallow their sputum. Piechaud and Bacquet (5) point out that bronchial secretions and sputum are unconsciously swallowed and also state that children under seven or eight years of age cannot expectorate unless they have an extensive ulcerative lesion. Women are said to swallow it more often than men and in our records they have more positives. Apart from bacilli one cannot always be sure which gastric contents actually contain sputum but it is doubtful if women differ very greatly from men in this respect.

While injecting iodized oil to visualize the bronchial tree Ulmar

and Ornstein (16) were surprised to find in at least two cases that a large quantity of the oil had found its way to the stomach. They further saw evidence of some oil actually spilling over from the trachea into the esophagus. At no time did these patients cough. They were of the opinion that sputum could be raised and swallowed in somewhat the same manner even by a patient who did not cough. When only a small amount of sputum is secreted and it is mucoid and tenacious it is difficult to raise, even by coughing, and in such cases is often swallowed before it can be spat up. Some patients quite consciously swallow sputum when in public places. Learoyd (19), in a recent article, even defends the practice as not being as harmful as is ordinarily supposed.

It is often possible to recognize by the naked eye sputum in the material aspirated from the stomach. We have sometimes fished out suspicious looking particles and found the smears undistinguishable from ordinary sputum smears. Such a procedure often simplifies the examination and saves time. At other times the sputum particles are small and must be collected by sedimentation and centrifugalization by the technique already described. Treatment with sodium hydroxide changes much of the mucoid material so that the bacilli, if present, can be concentrated into a smaller volume. Often, of course, there is little or no evidence of any sputum in the stomach contents.

On first admission to sanatorium some patients do not appear to understand about sputum and report that they have none, though tubercle bacilli are frequently found when a stomach lavage is done. Too much reliance cannot be given to a report of "no sputum", especially when x-ray and physical examinations show evidence of lesions which might be secreting sputum. In patients who report "no sputum" and in those with minimal or moderately advanced disease gastric lavage is a most valuable test and is often very useful in diagnosis. When the disease reaches the far advanced stage the test is usually less necessary.

In our experience gastric lavage for the demonstration of tubercle bacilli is a very valuable test in pulmonary tuberculosis, especially when the disease is not far advanced and when there is little or no sputum. The technique is comparatively simple and

more positive results can be obtained than when sputum alone is examined. The test could well be used in every institution where pulmonary tuberculosis is treated.

Summary

1. Of 500 gastric lavages done on 382 patients, nearly all having pulmonary tuberculosis, 121, or 24.2 per cent, revealed tubercle bacilli.

2. In 365 cases of pulmonary tuberculosis 121 out of 481 gastric lavages, or 25.2 per cent, showed tubercle bacilli in stomach contents.

3. One hundred per cent of the childhood, 6.7 per cent of the minimal, 24.2 per cent of the moderately advanced, and 29.0 per cent of the far advanced pulmonary tuberculosis cases had bacilli in stomach contents.

4. In pulmonary tuberculosis the sputum contained tubercle bacilli in 11.6 per cent of the examinations and the gastric contents in 25.2 per cent, i.e., the number with bacilli was more than doubled by the method of gastric lavage.

5. Of 56 lavages on patients with positive sputum 48.2 per cent revealed tubercle bacilli in the gastric contents.

6. Of 254 lavages on patients with negative sputum 12.2 per cent revealed tubercle bacilli in the gastric contents.

7. Of 171 lavages on patients with no sputum 36.8 per cent revealed tubercle bacilli in the gastric contents.

8. Of 107 patients having positive gastric lavages 66, or 61.7 per cent, were *first* found to have tubercle bacilli by this method.

9. The positive results were almost equally distributed between males (24.0 per cent) and females (24.3 per cent).

10. In 4 who had pleurisy with effusion and in 13 with non-tuberculous conditions the gastric contents and the sputum were negative.

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A NOTE ON SLIDE CLEANING

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Used microscopic slides, smeared with blood and other materials, stains, and dried immersion oil or balsam, are hard to clean. The cleaning process must be economical, for if expensive chemicals are used, cost of cleaning a slide closely approaches or exceeds the original cost of the slide. In many instances, used slides are first dropped into cresol solution, then washed, soaked in sulphuric acid-dichromate solution, washed again, finally wiped dry after soaking in 95% alcohol. The cresol solution must be stronger than the 2% solution commonly used in disinfection, as less than 10% strength acts very slowly in removing oily substances. Some prefer to add sodium or potassium hydroxide or soap to the cresol. All of these cresol solutions are caustic and injure the hands unless rubber gloves are worn. Some of the solvents used for slide cleaning are expensive, highly volatile, inflammable.

The following method of slide cleaning is economical, safe, and convenient. It consists simply of dropping used slides first in a solution of one part "phenolor"*, 4 parts water. Phenolor is a widely used hospital disinfectant and cleaner, is economical, non-inflammable, has a pleasant lavender odor, and does not injure the hands. After a few dozen slides accumulate in the jar of diluted phenolor, they are removed, washed in warm water, dipped in 95% ethyl alcohol, wiped dry. The phenolor is not discarded but may be used repeatedly until its detergent action weakens.

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* Squibb.

EDITORIAL

A. S. M. T. EXPANSION

The A. S. M. T. celebrated its 7th birthday May, 1939, in St. Louis, Mo. Today our membership is approximately 1/10 of the number of registered medical technologists. It is really deplorable that so few registered technologists are enjoying the privileges and the responsibilities of the A. S. M. T.

The A. S. M. T. is *our* organization and if we make it strong in the wealth of ability that abounds in registered medical technologists, the realization of our fondest hopes and aspirations will be a comparatively simple matter.

How can the membership be increased? This problem is before every member of the A. S. M. T. It is impossible for one person to solicit all registered medical technologists, but if the Registry, the American Journal of Medical Technology, and every individual member of the A. S. M. T. will support the extensive program recently adopted by the Society, the A. S. M. T. will start growing by leaps and bounds into a large and meritorious organization.

There are improvements needed in the conventions, and in our attitude toward our aims, ideals, and associations. These should come from a larger representation of medical technologists than that which now makes up the Society. They cannot be made unless a new spirit and renewed devotion to our ideals overwhelms the individuals forming the Society.

Every member of the A. S. M. T. is urged to secure one or more new members for the Society. We owe it to our fellow medical technologists to see that they are inspired with a desire to contribute

personally and actively to the progress and elevation of their profession.

Through the A. S. M. T. and its accomplishments, we should be able to indicate the worth of registration and the idealistic scope of our endeavor. Let us all rededicate ourselves to a new loyalty, and give the A. S. M. T. a chance to become what it has a right to be, an organization of which we can be justly proud.

ABSTRACTS

CONGENITAL AND FAMILIAL HEMOLYTIC DISEASE IN CHILDREN: R. Debre, M. Lamy, G. See and G. Schrameck. Am. Jr. Dis. of Children, vol. 56, No. 6, Dec., '38, p. 1189.

The authors give physical malformations, laboratory findings on blood, serum and bone marrow and genetic charts of the 14 families studied. Anemia may be absent. Splenomegali and reticulocytosis seem to characterize every case.

Hemolytic icterus is reported as a dominant familial trait, transmitted in the Mendelian ratio. Splenectomy is suggested as the only effective therapy.

SULFANILIMIDE ERUPTION: E. Schlesinger and W. Mitchell. Am. Jr. Dis. of Children, vol. 56, No. 6, Dec., '38, p. 1256.

A morbilliform eruption appeared 3-17 days after commencement of therapy, occasionally following several hours of fever and malaise. It faded completely in 48 hours if sulfanilimide was discontinued but lasted up to 72 hours if continued. Leucocyte counts ranged from 7,000 to 48,000 with neutrophiles 63-95%. The eruption was accompanied by some fever, with the white cells within or above normal. Leucopenia developed as the rash faded regardless of continuance or discontinuance of sulfanilimide.

A STUDY OF THE SENSITIVITY AND SPECIFICITY OF THE LAUGHLEN TEST AS COMPARED WITH THE WASSERMANN AND KAHN TESTS: H. W. Craig and J. L. Callaway. Am. Jr. Syph. Gon. & Ven. Dis., vol. 23, No. 1, Jan., '39, p. 76.

A report of all three tests on 1,000 cases. Complete agreement was found in 91.8%. The Wassermann and Laughlen agreed in 91.8% and the Kahn and Laughlen in 99.8%. The authors advocate inactivated serum for all tests.

EPIDEMIC DIARRHEA OF THE NEWBORN: C. J. Baker. Jr. Ped., vol. 14, No. 2, Feb., '39, p. 183.

A report of three outbreaks in the New York Hospital. Though extensive cultural studies were made of stools and of every possible source of contamination, no one organism or source of contamination could be determined. Among the premature infants, however, B. coli mutabile or hemolytic B. coli or both were obtained in 70% of the cases.

MOLD SPORE CONTENT OF THE AIR IN BOSTON WITH REFERENCE TO ATOPIC SENSITIVITY: H. N. Pratt. Jr. Ped., vol. 14, No. 2, Feb., '39, p. 234.

Daily mold spore counts were made. Children were tested for sensitivity to the more common ones and the reagin content of their sera was determined. Where tests were positive, improvement under specific treatment substantiated the findings. Especial emphasis is placed on Alternaria.

THE RELATION OF POTASSIUM TO PERIODIC FAMILY PARALYSIS: G. D. Gammon, J. H. Austin, M. D. Blithe and C. G. Reid. Am. Jr. Med. Sci., vol. 197, No. 3, No. 804, p. 326.

Report of a case in which muscular weakness rapidly going to paralysis could be produced or relieved by varying the amounts of potassium and of water. The patient's father was found to have the same condition.

WATER-BORNE OUTBREAK OF BRUCELLA MELITENSIS: A. W. Newitt, T. M. Koppa and D. W. Gudakunst. Am. Jr. Pub. Health, vol. 29, No. 7, July, '39, p. 739.

Report of an outbreak of Brucella melitensis infection with 80 cases and one fatality, in a college bacteriology building. The source was a laboratory handling many B. melitensis cultures. The sterilizer used for killing was found to leave the agar unmelted. These plates were washed in a sink with a rubber tube hanging from the faucet and frequently coming in contact with the wash water. The water pressure was sufficiently low to permit a negative pressure and siphonage of this unkilled material into the water supply of the whole building.

AN INEXPENSIVE SHAKING MACHINE: R. D. Haire. Am. Jr. Syph. Gon. & Ven. Dis., vol. 23, No. 1, Jan., '39, p. 102.

Directions are given for a shaking machine using an electric fan motor and other readily available materials. The number of shakes can be controlled and calculated.

THE CRITERIA OF A DEPENDABLE BASAL METABOLISM REPORT: P. Roth and P. Buckingham. Am. Jr. Clin. Path., vol. 9, No. 1, Jan., '39, p. 79.

With the coming of the newer, simpler basal machines, the test has become available to a large number of people who are not sufficiently competent to perform a reliable test. Criteria of a test are given with the plea that more attention be given to the way in which these tests are carried out.

MACROCYTIC ANEMIA, OTHER THAN PERNICIOUS ANEMIA, ASSOCIATED WITH LESIONS OF THE GASTRO-INTESTINAL TRACT: C. C. Sturgis, S. Milton Goldhamer. Ann. Int. Med., vol. 12, No. 8, Feb., '39, p. 1245.

The authors report blood, gastric analysis and clinical findings in a group of cases of gastro-intestinal lesions which show that macrocytic anemia may also occur without the other findings of pernicious anemia. It is suggested that the degree of anemia and the onset of symptoms is dependent upon the size and position of the lesion and the amount of intrinsic factor stored in the liver or other storage tissues.

CHRONIC BRUCELLOSIS (UNDULANT FEVER); AN ANALYTICAL STUDY OF THE POSITIVE REACTORS AMONG SCHOOL CHILDREN: F. E. Angle and W. H. Algie. Ann. of Int. Med., vol. 12, No. 8, Feb., '39, p. 1189.

Nine per cent or 642 of the children tested gave positive allergic skin tests. These children were found to show a much higher percentage of chronic illness than those with negative skin tests. Laboratory work to determine the degree of activity was not done but the above findings suggest that subclinical cases may be rather common.

BOOK REVIEWS

A TEXTBOOK OF MEDICAL BACTERIOLOGY by David L. Belding, M.D., Professor of Bacteriology and Experimental Pathology, Boston University School of Medicine, Boston, Massachusetts, and Alice T. Marston, Ph.D., Assistant Professor of Bacteriology and Immunology, Boston University School of Medicine, Boston, Massachusetts. In collaboration with the following members of the Department of Bacteriology, Public Health, and Preventive Medicine of Boston University School of Medicine: Sanford B. Hooker, M.D., Professor of Immunology; Sidney C. Dalrymple, M.D., Dip. Bact. (London), Associate Professor of Bacteriology; José P. Mill, M.D., Dr. P.H., Assistant Professor of Public Health and Preventive Medicine and Matthew A. Derow, M.D., Instructor in Bacteriology and Immunology. Pp. 592. Publishers, D. Appleton-Century Company, 35 West 32nd St., New York, 1938. Price $5.00.

This work is designed by the authors to fill a need for a concise yet comprehensive bacteriology intermediate between the more voluminous reference books and the elementary texts. The material includes a great many subjects and to cover them all in a book of this size it has been reduced to the more essential facts. Only one aspect of controversial subjects is given and only such recent advances that have proved their worth are included. The book does not attempt to supplant the more exhaustive textbooks on bacteriology but is primarily a teaching text, presenting the basic principles of bacteriology in a condensed form to meet the requirements of the medical student and practicing physician. Yet the comprehensiveness of the work is appreciated in noting the contents and numerous subtitles of the nine sections which include general and medical bacteriology, pathogenic enbacteriales, actinomycetales and fungi, spirochaetes, viruses, rickettsiae and bacteriophages, immunity and sanitary and economic bacteriology. The material has been carefully selected and nothing of importance has been omitted. All references except those of historical interest and of recent investigations have been omitted to keep the volume

of convenient size. The relationship of bacteriology to public health and preventive medicine has been emphasized. Immunity has been treated as a distinct entity rather than the usual historical relationship to bacteriology. The sections on fungi and ultramicroscopical viruses have been dealt with at greater length because of their increasing importance.

GROSS ANATOMY, A Brief Systematic Presentation of the Macroscopic Structure of the Human Body by A. Brazier Howell, Associate Professor of Anatomy, Johns Hopkins University School of Medicine. Pp. 403. Illus. 56. Publishers, D. Appleton-Century Company, 35 West 32nd St., New York. Price $6.00.

An abbreviated description of the gross anatomy of all the systems of the human body is presented in this work. The author intends the book as a short cut to anatomy for students (presumably medical students) and attempts to separate the essentials from the non-essentials of human anatomy, eliminating the minutiae of detail which other complete works of anatomy include. By so doing he feels that many hours of the student's time and effort are saved for devotion to other subjects and that an attitude of hopelessness, discouragement and futility is spared the student who is required to use the more voluminous texts of anatomy which the author feels should be used for reference only. He also states that the instructor cannot distinguish to his student the important from the unimportant details. And yet he attempts to do this in a text. It is difficult to say whether or not the author accomplishes his purpose and even if he does the question remains whether it is a worthy one. For who shall say what are the essentials and non-essentials of human anatomy? If a student is required to read this book and then has to start in all over again with one containing complete anatomical descriptions and learn them "the hard way" i.e., by time and studious effort, then the time and effort spent in reading this text must have been wasted, as certainly the student will have gained the knowledge contained herein as well as a great deal more. In defense of this work however, it must be admitted that even after minutiae of detail and hundreds of new names are learned by the student of anatomy, much of it is forgotten in

due course of time and the student retains only the "essentials." But even this does not completely justify giving the student only the essentials to start with, as throughout the remainder of his career he will continually encounter terms which will call to mind their essential meaning if he has once learned them; but if he has never been "exposed" to them he misses much in his subsequent medical study and reading. This reviewer is still old fashioned enough to believe that there is no short cut to such subjects as anatomy albeit there are many students who wish that there were. However, for those who want only a limited knowledge of anatomy as an aid in some related line of medical or technical endeavor this book is highly recommended.

TEXTBOOK OF PATHOLOGY. A Correlation of Clinical Observations and Pathological Findings by Charles W. Duval, M.D., Professor of Pathology and Bacteriology, Tulane University School of Medicine; Chief Visiting Pathologist, Charity Hospital, New Orleans; Consultant in Pathology, Touro Infirmary, New Orleans, and Herbert J. Schattenberg, M.D., Associate Professor of Pathology and Bacteriology, Tulane University School of Medicine; Visiting Pathologist, Charity Hospital, New Orleans. Pp. 681. Illustrations 373. Publishers, D. Appleton-Century Company, 35 West 32nd St., New York, 1939. Price $8.50.

A very commendable feature is followed throughout in this work, namely, that the relationship of the basic sciences of anatomy, physiology, biochemistry, pathology and clinical medicine are correlated. Pathology is not treated as a "morgue" or "dead-house" subject. The clinician who thinks of his patient's symptoms and physical findings in terms of pathology is the one who is thinking most clearly. This book aids in accomplishing this purpose and by gaining knowledge in this manner the clinician and student may better correlate the findings in the living patient with the pathology present. If medicine as a whole were a cut and dried subject in which by certain tests and examinations we were able in all instances to say that definite pathological conditions exist it would be a pure science and not an art as well as a science. But all too frequently the clinician, even after a most complete work-up of his case under

the best hospital facilities, is surprised at the findings of the pathologist at the autopsy table and under the microscope. Therefore any attempt at correlation of pathology with clinical medicine, as this book does in a most admirable and satisfactory manner, is to be highly commended. The author's style of writing is direct and readily understandable. Diseases of all the systems are included in the text. It is noteworthy that the most outstanding authorities are included in the references to the American literature. Foreign references are not included, the authors assuming that such may be consulted if desired through the Index Medicus. Ample illustrations of gross lesions and photomicrographs supplement the text.

MEDICAL VOCABULARY and Phrases in English, German, French, Italian and Spanish by Joseph S. F. Marie. Foreword by Chevalier Jackson, M.D., Sc.D., LL.D., F.A.C.S., Honorary Professor of Broncho-Esophagology and Consultant in Broncho-Esophagologic Research, Temple University, School of Medicine, Philadelphia. Pp. 358. Publishers, P. Blakiston's Son & Co., Inc., Philadelphia.

Words are arranged in five columns under the headings of English, German, French, Italian and Spanish. With war clouds threatening over Europe at this time such a volume as this is most timely and, unless one is freely conversant in all these languages, will be found imminently useful to anyone who may have to serve in a European war in any medical capacity. It would be an enormous time-saver to those attending international medical congresses, those in public health service and to military medical officers. There are sufficient medical phrases given in the five languages to at least offer some basis of mutual understanding in event of foreign service.

NEWS AND ANNOUNCEMENTS

NATIONAL

Following is a copy of letter received at the Editorial Office from Sister M. Alma (LeDuc) formerly of Akron, Ohio, and now doing mission work in India:

HOLY FAMILY HOSPITAL
Murree Road
Rawalpindi, India

A copy of the American Journal of Medical Technology arrived a few days ago and you may be sure that I appreciated seeing it.

Now here I am at the end of the world, about 12,000 miles from Michigan. Rawalpindi is about a hundred miles from the Northwest Frontier of India, just below forbidden territory which Lowell Thomas describes so well in BEYOND KHYBER PASS. The lower ranges of the Himalayas are about sixty miles away and give us a lovely view all along the North horizon. Rawalpindi (nobody but God knows the population—which may be anywhere from 200,000 to 500,000) is the headquarters for the Northern Army, and Murree, which is 6000 feet higher and two hours away, is its summer headquarters. Murree Road, on which the hospital is located, is a sort of Lincoln Highway in the north of India, connecting Rawalpindi with Murree, and was a highway of some kind a thousand years or more before America was discovered—probably before Alexander the Great passed over it; and certainly was ancient history before Kipling discovered it. So much for the setting.

The hospital is brick and cement—cement floors throughout. It is a hospital for women and children—but in the European section—for the sake of accommodation—we sometimes have a European

male patient who doesn't want to go to the military hospital. The women are largely Mohammedan, Sikh and Hindu. Purdah is quite general in this section. It is quite an achievement that more and more of the women are making use of the hospital and the two dispensaries attached.

I have not been here long enough to give a good picture of conditions or to make a scientific report, but a few general remarks will help to make things clearer. The type of patients, the diseases from which they suffer, the method of managing them, etc., are all topics which would take pages in themselves. I am now speaking only of the natives. In the first place practically everyone who comes to the hospital or dispensary has malaria. Dysentery, intestinal parasites and tuberculosis perhaps come next. However, the patient does not necessarily come in for that reason. Many of the patients are maternity cases and come to the hospital for confinement. Invariably they will get a flare-up of their malaria, and the problem is to decide whether the persistent temperature is due to that or puerperal sepsis or tuberculosis or a mixture of several conditions. The patients who get an anesthetic for some simple operation will get a malarial attack. It has been found that an anesthetic commonly brings about such an attack. I haven't been here during the hot weather yet but they tell me that at that time the dispensary is beseiged with children with infected insect bites.

I haven't done a great deal of laboratory work as yet. Mission work is quite different from hospital work at home. First there is the matter of expense—and mission hospitals are usually not so well off financially. Then there is time and climatic conditions and other factors.

We have a laboratory with a good microscope, plenty of stains (B. & W. Soloids) material for complete blood counts, differentials, bacteriological slides (no culture media) and a Kahn outfit. Most of our patients suffer from anemia, some extremely low hemoglobins, due largely to malaria and also to a deficient diet. A good Hindu never eats meat or eggs so it is hard to get the right food for them. So far I have done blood counts as necessary, many stool examinations, malaria slides, ordinary bacteriological smears, cross-agglutinations for transfusions—which does very well. I haven't

experimented with the Kahn yet—but must get some things cleared up first. I have been reading a lot about the positive tests one gets with malaria patients. As almost all our native patients have or did have malaria I would expect most anything. I do not have the equipment for tissue examinations, but so far with the types of cases we have had I would think that a minor matter and wonder whether it would be worth the trouble and expense. Urinalyses, of course, are done freely, and especially in pre-natal work—which is one of our specialties in our dispensaries. We do not have an X-Ray machine, but that too is not so necessary, as we can send patients to the Military hospital for X-Rays when that is indicated. I can see that in this type of work we must spend the money and time on those things which will benefit the most people. Preventive work is essential. And with malaria, tuberculosis, typhoid and other enteric infections, the public health problem is largely educational.

We have a training school here, recognized by the government, in which we give a nurse's course and also a course for midwives. There are Native Indian Sisters who are sending their Sisters here for training and they make very good nurses and midwives. As maternity work otherwise is almost entirely in the hands of ignorant native midwives who do more harm than good this is an important work. However, as it will take too long to replace the native midwives, that problem is being partly solved by having Maternity and Child Welfare Centers where the native midwives come for instructions and do their work under supervision. It is slow work but there is some improvement every year. We have one of those centers here under our supervision.

All in all the whole work is so interesting and there is so much to be done that you may be sure that I do not regret coming here. In fact I expect to remain here for the rest of my life and will consider it well spent if I can help raise the standard of health work a little.

Give my kindest regards to all my friends in the A. S. M. T. and many thanks for sending me the Journal. I don't want to get too rusty.

Sincerely yours,

SISTER M. ALMA (LEDUC).

The Institute for Research has just completed a study of and produced a monograph on "Career as a Laboratory Technician" (Medical Technologist).

Address your inquiries to The Institute for Research, Devoted to Vocational Research, 537 South Dearborn Street, Chicago, Ill.

The publishing house of P. Blakiston's Son & Co., Inc., specializing in scientific and medical books, has been purchased by Horace G. White from the Executors of the Estate of Kenneth M. Blakiston. This business was established by Presley Blakiston in 1843, and was continuously in the Blakiston family until the death of Kenneth M. Blakiston in 1937. The policies which have made this o'd established concern so successful will be carried on by Mr. White, who has been connected with the company for over twenty-eight years, under the name of The Blakiston Company. The officers are Horace G. White, President; Robert F. Bowman and Charles C. Norris, Jr., Vice-Presidents, Edmund J. Glaser, Treasurer, and Edward B. Barnes, Secretary.

Minnesota

"The Minnesota Medical Technologist" will be issued once during the summer and again in October, January and April of the coming year.

At the annual election of the Minnesota Society of Medical Technologists in May, the following officers were installed:

Frieda Claussen of St. Paul, President; Adelaide Evenson of Minneapolis, President-Elect; Catherine Hanitsch, Glen Lake, Vice-President; Laila Punkari, St. Paul, Secretary; Sister Edeltrude of St. Paul, Treasurer.

Featured on the various committees are:

1. Committee of Standards and Studies, Margaret Keough, St. Paul, chairman.
2. Membership Committee, Mae Collins, St. Paul, chairman.
3. Nominating Committee, Sister Alcuin, Duluth, chairman.

4. Editors of the paper, Adelaide Evenson, Minneapolis, and Catherine Hanitsch, Ten Lake.

5. New director of the society, Olga Nelson.

The latter part of August was the date set for the Medical Technologist's Adult Educational Course at the University Continuation Center. At that time a meeting of the Minnesota Medical Technologists took place very informally. The purpose being to transact the society's business which had accumulated by that time, as well as to strengthen the professional and social spirit of the Technologists of the State of Minnesota.

Texas

The seventh annual convention of the Texas Society of Medical Technologists will be held at the Hotel Adolphus in Dallas, October 6th and 7th. All out-of-state visitors will be welcome.